

Poster Session 10: Biological effectiveness of Particle Therapy

Fractionated irradiation of carbon beam and the isoeffect dose on acute reaction of skin

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Purpose: The aim of this study was to clear any specific LETs cause change in skin reaction. We irradiated mice feet with mono-energetic and SOBP carbon ions, to obtain dose–response of early skin reaction at different LETs.

Materials and methods: *Mice:* C3H/HeMsNrsf female mice aged 4 months old were used for this study. The animals were produced and maintained in specific pathogen-free (SPF) facilities. *Irradiation:* The mice right hind legs received daily fractionated irradiation ranged from single to six fractions. Carbon ions ($^{12}\text{C}^{6+}$) were accelerated by the HIMAC synchrotron to 290 MeV/u. Irradiation was conducted using horizontal carbon-ion beams with a dose rate of ~ 3 Gy/min. We chose the LETs at entrance of plateau (20 keV/ μm) and the SOBP (proximal: 40 keV/ μm , middle: 45 keV/ μm , distal: 60 keV/ μm , distal-end: 80 keV/ μm). The reference beam was ^{137}Cs gamma rays with a dose rate of 1.2 Gy/min. *Skin reaction:* Skin reaction of the irradiated legs was scored every other day, between the 14th and 35th post-irradiation days. Our scoring scale consisted of seven steps, ranging from 0.5 to 3.5 [1]. The skin score analyzed a result by the method that described by Ando *et al.* [2]. The Fe-plot proposed by Douglas and Fowler was used as a multifraction linear quadratic model. A plot between the reciprocal of the isoeffect dose and the dose per fraction resulted in a straight line.

Results: Required isoeffect total dose increased linearly with the fraction numbers on a semi-logarithmic chart at LET 20–60 keV/ μm SOBP beam. The isoeffect total dose decreased with the increase in the LET. However, no increases in isoeffect total dose were observed at few fractionations at 80 keV/ μm . (data not shown) Using an Fe-plot, we analyzed the isoeffect total dose to evaluate the dependence on Carbon beam, or gamma ray. When I irradiate it by gamma ray, an Fe-plot shows linearly. But, irradiated by Carbon beam, an Fe-plot bent at low fractions (Fig. 1).

Conclusion: The LQ-model-based Fe-plot could not fit skin reaction at few fractions at high-LET.

Clinical Trial Registration number if required: No.

Keywords: skin reaction; high-LET; fractionation; Fe-plot

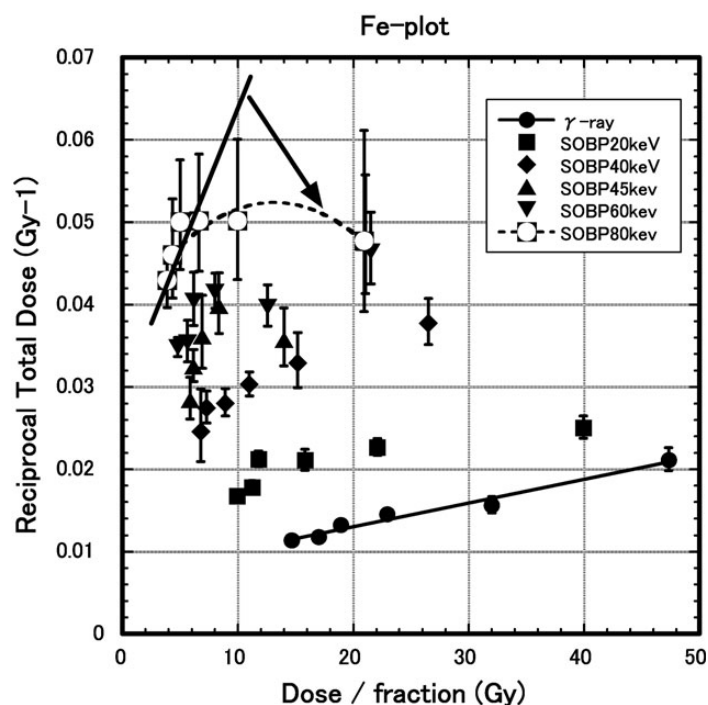


Fig. 1. The reciprocal of the isoeffect dose is plotted against the dose per fraction. (i) Gamma ray: Fe-plot was linear. (ii) C-ions: Fe-plot bent at low fractions.

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